ASSESSMENT OF FIELD TRIP AS A PEDAGOGICAL STRATEGY FOR TEACHING SUSTAINABLE DEVELOPMENT AGENDA AT HIGHER EDUCATION LEVEL

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Abstract
The study assessed field trip as a pedagogical strategy for teaching sustainable development agenda at higher education level. The three sites considered in this study are Organic Waste (Biomass) Conversion Plant, Wastewater (Sewage) Treatment Plant and Hydropower Plant. Stratified Random Sampling Technique was used for selecting two hundred and seventy Integrated Science students from three Colleges of Education for the study. Excursion for Sustainable Development Questionnaire (ESDQ) was used for the study. Two hypotheses were tested in the course of the study. The responses of the respondents were analysed using Chi Square statistics. The findings showed that most of the students were positively predisposed to the privileges derivable from the three renewable plants sites in the following areas: social benefits, skill acquisition and job creation. While many students (mostly female) aspired to be engaged in biomass conversion business, only few students (mostly male) agreed to venture into studies relating to sewage and hydropower plants because of the perceived high risk management involved. As a result of the positive inclination of students to field trip, it was recommended that field trip should be encouraged in the school as another practical oriented approach in order to expose students to academic reality, facilitate access to practical knowledge, boost students' interests in academic work, enhance students' academic performance and foster innovations for energy sustainability.

KEYWORDS: Field Trip, Pedagogical Strategy, Sustainable Development.

INTRODUCTION

According to Adejumo and Adejumo (2014), the term 'sustainable development' began to gain popularity when it became increasingly fashionable to use it as a way of responding to global environmental concerns, biophysical issues, fairness, equity and distribution. Okorie (2010) affirmed that the common use of the term 'sustainability' began with the 1987 publication of the World Commission on Environment and Development report (Our Common Future) which defined sustainable development as a development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. In the words of Westman, Pettersson and Hurst (2016), sustainable development means inspiring people in all parts of the world to find solutions that improve their quality of life without storing up problems for the future, or impacting unfairly on other people's lives.

Education for sustainable development is a vision of education that seeks to balance human and economic well-being with cultural traditions and respect for the earth's natural resources (Wals and Kieft, 2003). Similarly, UNESCO (2002) described education for sustainable development as an emerging but dynamic concept that encompasses a new vision of education that seeks to empower people of all ages to assume responsibility for creating a sustainable future. The three spheres of sustainability development are economy, environment and society with an underlying dimension of culture. In other words, education for sustainable development must explore the economic, political and social implications of sustainability by encouraging learners to reflect critically on their own environment.

In addition to the provision of scientific and technical skills, education also provides the justification and motivation for applying the skills and pursuing technological growth. In line with the sustainable global agenda, United Nations (2015) enjoined all educators to ensure by 2030, all learners acquire knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and nonviolence, global citizenship and appreciation of cultural diversity and cultural contribution to sustainable development.

Giwa, Alabi, Yusuf and Olukan (2017) stated that on September 25, 2015, the 17 Sustainable Development Goals (SDGs 1-17) were adopted by the world leaders to replace the Millennium Development Goals (MDGs) and set a clear agenda for the eradication of poverty, inequality, and environmental pollution by 2030. Items 6 and 7 of the adopted seventeen Sustainable Development Goals of the United Nations General Assembly 2030 Agenda dealt with water and energy related issues for the citizens. The sixth item is concerned with clean water and sanitation while the seventh item deals with affordable and clean energy. The agenda expected availability and sustainable management of water and sanitation for the populace. Likewise, the agenda looked forward to affordable, reliable, sustainable and clean energy for the member nations. According to United Nations (2015) Development Programme, a crucial goal that is well-connected to many of the other goals is Sustainable Development Goals No. 7, which is to ensure universal access to clean and cost-

effective energy. World Energy Council (2016) noted that sufficient and secure energy is the main enabler for welfare and economic development of a society.

In order to achieve the goals, Westman et. al. (2016) suggested that global goals 6 and 7 can be realised by making field trips to the local sewage and water treatment plant, to the green energy plants such as hydropower plant or the wind power station and solar power plant. Pedagogical approaches that are particularly effective in the context of education for sustainable development tend to have an authentic aspect, enabling students to relate their learning to real-life problems and situations (Quality Assurance Agency, QAC, 2014). Experiential project work, case study, field trip or excursion are some of the pedagogical approaches for teaching and achieving Sustainable Development Goals by students in order to develop a life-long education.

A handful of science concepts are strategically selected for teaching sustainable development project. Out of these sustainable development science concepts, field trip was chosen for this study. According to Gray (2018), field trip is an activity where students venture outside of the classroom to partake in hands-on learning experiences that relate directly to the grade's curriculum. Wikimedia Commons (2018) defined field trip (excursion) as a journey by a group of people to a place away from their normal environment. In the course of the excursion, students are given the autonomy to observe and participate by asking questions. In some sites, prescriptions are provided by the owners or caretakers who make students to depend solely on the directives of their teachers. Other examples of field trip sites include science museums, water works, fire stations, amusement parks, factories, zoological garden, public and private agencies.

By exploring the relevance of field trip, Steve (2016) noted that students will experience a more holistic, integrated picture of the information that, in the classroom, may have only been presented in a textual and abstract way. April (2018) also submitted that field trip assists in enhancing the curriculum, offering new learning environment to students and encouraging team building among students. That is, it helps students to have first-hand experiences with the subject matter that they have learned in the class. According to Wikimedia Commons (2018), Charles Darwin is an important example of someone who has contributed to science through the use of field trips. For the present students, field trip also provides students with the opportunity for fun and excitement, exposes students to an actual and hands-on learning experience and gives students the opportunity to visit new places and new environment.

In spite of the advantages of field trip, it has certain disadvantages. Although it is an effective educational activity for students that helps facilitate fast and efficient learning method (Marky 2012), the activity can also bring negative consequences if not properly managed. In the first instance, field trip has high financial implication on the part of the students if it involves long distance or restricted organisations. Every excursion requires adequate preparation to prevent or reduce hazards. If not properly arranged, the excursion could

amount to fruitless exercise and waste of resources. While on the field, students may experience mishap or industrial accident which necessitates for proper safety precautions.

The sites considered in this study are Organic Waste (Biomass) Conversion Plant, Wastewater (Sewage) Treatment Plant and Hydropower Plant. According to Olayinka, Sunday and Oluseyi (2011), Nigeria is endowed with abundant natural energy carrier resources including crude oil, natural gas, coal and lignite, tar sand, hydropower (large and small), solar radiation, wind, biomass (fuel wood, animal and plant wastes) and nuclear element deposits.

In Nigeria, energy resources are classified based on their renewability. While some are renewable, others are non-renewable. Osueke and Ezugwu (2011) defined renewable energy sources as sources that can be replenished or produced quickly through natural processes while non-renewable energy resources are resources that cannot be produced, generated, grown or used on a scale that can sustain its consumption rate because they will not be available for future need once they are depleted. It indicates that the rate at which the renewable energy is used does not affect their availability in future and as such cannot be exhausted. However, the non-renewable energy is consumed much faster than nature can create them. Although, usage by human beings depletes renewable resources, they are often replenished. On the other hand, the rate of formation of non-renewable resources is extremely slow. Examples of renewable energy resources include wind energy, solar energy, hydro-energy and biomass energy. Examples of non-renewable energy resources include coal, natural gas and petroleum.

The biomass conversion plant converts organic waste to high grade organic fertilizer and feedstock for biogas that would be turned into renewable electricity, cooking, lighting and heating. Biomass is any organic material which has stored sunlight in the form of chemical energy. According to West African Economic and Monetary Union (2008), which is represented by its French acronym, UEMOA, biomass resources are from three sources of biomass: primary (seed, plants, trees and crops), secondary (sawdust, black liquor and animal waste) and tertiary sources (animal fats and greases). Biomass serves areas with high population density that generates the most waste by transforming the waste generated into energy used to power homes and businesses (Federal Republic of Nigeria, 2016). However, traditional biomass, using wood, charcoal and agricultural residues for cooking and heating, is inefficient and poses health risks (Lacey, 2017).

Hydropower is the leading renewable source for electricity generation globally, supplying 71% of all renewable electricity at the end of 2015 (World Energy Council, 2016). Hydro-energy is the largest source of renewable energy. Most of the productive activities in agriculture, commerce, manufacturing companies, industry and mining are supported by energy. Universally, power generation is the means of generating power supply into the society. In most cases, lack of access to adequate and regular supply of energy often contributes to economic decline and result in poverty and deprivation. Subsequently, the

energy situation in Nigeria is critical and may be a key constraint for economic development if not well harnessed.

Purpose of the Study

At present, humanity uses energy for numerous functions such as farming, cooking, medical treatment and transportation. It is very obvious that energy consumption makes up a big part of our daily lives. Whether renewable or non-renewable, how does a student perceive the societal benefit, environmental impact and the risk involved in the various renewable energy sources? Since fossil fuels cause serious danger to the environment, three renewable energy sites (Biomass Conversion Plant, Sewage Treatment Plant and Hydropower Plant) were considered vis-à-vis the Sustainable Development Goals. Field trip is regarded as part of out-of-school programme (Wirt, Choy, Rooney, Porvasnik, Sen, 2004). The study therefore assessed field trip as a pedagogical strategy for teaching sustainable development agenda at higher education level.

Research Hypothesis

There is no significant relationship between groups' observations and sustainable development agenda.

There is no significant relationship between Sustainable Development Goals and field experiences in Biomass Conversion Plant, Sewage Treatment Plant and Hydropower Plant.

Population and Sampling Technique

The population was made of Colleges of Education in the South-West states of Nigeria. Three Colleges of Education from three states were chosen for the study. The criterion for selection was based on students' exposure to field trip in the renewable energy sites. Ninety Part III students were drawn from Department of Integrated Science of each institution. Stratified Random Sampling Technique was used for selecting Integrated Science students out of various combinations in the School of Science. Altogether, two hundred and seventy students were used for the study.

Research Instrument

Excursion for Sustainable Development Questionnaire (ESDQ) was used for the study. The questionnaire aims at harvesting the observations and experiences of the students in the three renewable energy sites vis-à-vis the sustainable development agenda. It had two sections, A and B. Section A consists of the bio-data of the respondents. Section B consists of twenty-four objective questions under the following headings: Societal Benefits of the Renewable Energy sites, Derivable Skill Acquisition for the society, Environmental Impact, Job Creation, Gender Inequality, Risk Management, Career Affiliation and Student Preference to Field Trip in relation to Classroom Work.

Research Methodology and Method of Data Analysis

Group A represented the first college which was exposed to Biomass Conversion Plant. Group B represented the second college which was exposed to Sewage Treatment Plant.

Group C represented the third college which was exposed to Hydropower Plant. The questionnaire was administered to the groups as post excursion exercise. The responses of the respondents were analysed using Chi Square statistics.

Research Findings and Discussion

Research Hypothesis 1: There is no significant relationship between groups' observations and Sustainable Development Goals (SDGs).

Table 1: The Chi-square of Groups' Observations and SDGs Relationship

GROUP	SOCIETAL BENEFIT	SKILL ACQUISITION	ENVIRONMENTAL IMPACT	JOB CREATION	ROW	χ^2	Crit	df	P< 0.05
GROUP A	75 (28.85%) 76.53	84 (32.31%) 72.17	25 (9.62%) 41.44	76 (29.23%) 69.85	260	20.23	12.59	6	Sig.
GROUP B	68 (32.54%) 61.52	60 (28.71%) 58.03	31 (14.83%) 33.31	50 (23.92%) 56.15	209				
GROUP C	86 (27.83%) 90.95	72 (23.30%) 85.79	68 (22.01%) 49.25	83 (26.86%) 83.01	309				
COLUMN	229	216	124	209	778				

Source: Researcher's Field Work

The table displayed students' observations in each energy site in relation with four Sustainable Development Goals (SDGs). The findings from the table confirmed that chi square calculated value (20.23) is greater than chi-square critical value (12.59). Then, the null hypothesis that states that there is no significant relationship between groups' observations and sustainable development agenda is rejected. Therefore, there is significant relationship between groups' observations and Sustainable Development Goals (SDGs).

In the area of societal benefits, 75 Group A students (out of 90) observed great benefits of biogas conversion plant, 68 Group B identified with the advantages of sewage treatment plant while 86 Group C students were favourably disposed to the gains of hydropower plant. Biomass converting plant produces fertilizer and biogas, entrepreneur training and youth empowerment programmes and converts waste to energy according to SDG 12. Sewage Treatment Plant produces water for domestic usage, fishing and farming while hydropower plant produces electricity for domestic and industrial usages.

The second section of students' responses covered skill acquisition. Eighty-four (84) students in Group A, 60 students in Group B and 72 students in Group C agreed that the three sites are very educative and useful to all the society. It boosts interest for science enquiry, yields scientific and technical skills and produces practical experience needed for innovation and industry in line with SDG 9. As regards job opportunities, most of the students concurred that

all the three sites have great potential to create job for low, medium and high income earners for poverty eradication in line with SDG 1.

In the area of environmental impact, only 25 students (representing 9.62%) responded in Group A. This indicates a low environmental impact for biogas converting plant they visited. According to Okorie (2010), the impact of fossil fuels on the environment sparked off the quest for alternative energy sources that are environmentally friendly. Biomass energy has been tipped as future energy because of its attributes of low carbon emission and socio-economic benefits. However, 68 students (representing 22.01%) consented to high environmental impact of hydropower plant site.

Some of the sites have potential health hazard, localised pollution, hazardous chemicals and offensive odour because of the obsolete strategy and equipment employed. The findings agreed with KIS Group (2018) that most of the waste is left to decompose in the open which emit air pollutants such as methane, nitrous oxide, ammonia, hydrogen sulphide, volatile organic compounds and particulate matter that pose a significant environmental hazard and cause serious health problems. It indicates that some of the wastewater treatment plants for the disposal of industrial wastes create the avenue of exposing treatment plant workers to hazardous chemical compounds that may be present in these wastes. This contradicts good health and well being as stated in SDG 3.

In the areas visited by the students, biomass conversion plant and sewage plant have few centres and small area where the environmental impact can be felt. Consequently, the respondents agreed that the two plants have little environmental impact in terms of national coverage. However, hydropower plant has wider coverage and greater environmental impact due to many hydropower plants and dams nationwide. According to World Energy Council (2016), as energy-related activities have significant environmental impacts, it is indispensable to provide an energy system which covers the needs of the economies and preserves the environment.

Research Hypothesis 2: There is no significant relationship between Sustainable Development Goals and field experiences in Biomass Conversion Plant, Sewage Treatment Plant and Hydropower Plant.

Table 2: The Chi-square of Energy Sites Experiences and SDGs Relationship

PLANT TYPE	GENDER INEQUALITY	RISK MANAGEMENT	CAREER AFFILIATION	STUDENT PREFERENCE	ROW	χ^2	Crit	df	P< 0.05
BIOMASS	70 (25.09%) 78.84	35 (12.54%) 67.58	86 (30.83%) 49.24	88 (31.54%) 83.35	279	68.61	12.59	6	Sig.
SEWAGE	86 (28.67%) 84.76	85 (28.33%) 72.66	42 (14.00%) 52.94	87 (29.00%) 89.62	300				
HYDRO-ENERGY	89 (30.90%) 81.38	90 (31.25%) 69.76	25 (8.68%) 50.82	84 (29.17%) 86.03	288				
COLUMN	245	210	153	259	867				

Source: Researcher's Field Work

The findings from Table 2 revealed that chi square calculated value (68.61) is greater than chi-square critical value (12.59). Then, the null hypothesis that states that there is no significant relationship between Sustainable Development Goals and field experiences in Biomass Conversion Plant, Sewage Treatment Plant and Hydropower Plant is rejected. Therefore, there is significant relationship between Sustainable Development Goals and field experiences.

In the table, student responses (70, 86 and 89 students respectively) indicated gender imbalance in all the sites. Number of male staff was far more than female staff. The gender inequality was more pronounced in the hydropower plant contrary to SDG 5 that advocates for gender equality. The finding also indicates that the risk management was low (easy to manage) in biomass plant, high in sewage plant and higher in hydropower plant because of the quantum of water and electric current experienced by the students.

Based on the varying degree of risk involved, there were differences in students' level of attachment in choosing any of the field trip sites as their future career or decent work as stated in SDG 8. Eighty-six students (mostly female) opted for biomass plant as their future career. Forty-two students decided for sewage treatment as their future career. Twenty-five students (mostly male), chose hydropower site to be their future vocation. Overwhelming responses of students showed their preference for excursion over classroom work because of its numerous advantages. They advocated for the use of field trip in explaining many scientific concepts learnt in the classroom. Majority of them saw field trip as a practical oriented approach which exposes students to academic reality and boost their interests in academic work.

Conclusion and Recommendation

The study paid attention to the Sustainable Development Goals 6 and 7. Item 6 ensures availability and sustainable management of water and sanitation for all while item 7 ensures access to affordable, reliable, sustainable and modern energy for all. The research work engaged in the opinions of students on sustainable water and energy through excursion to biomass converting plant, wastewater treatment plant and hydroelectricity plant.

The findings showed that most of the students were positively predisposed to the privileges derivable from the three renewable plants sites in areas like social benefits, skill acquisition and job creation. While many students (mostly female) aspired to be engaged in organic matter converting business, only few students (mostly male) agreed to venture into studies relating to sewage and hydropower plants because of the perceived high risk management involved. The researcher then recommended that government should redouble her effort in securing environmentally safe energy.

As a result of the positive inclination of students to field trip as an effective strategy for teaching sustainable development agenda, it was recommended that field trip should be encouraged in the school as another practical oriented approach in order to expose students to academic reality, facilitate access to practical knowledge, boost students' interests in academic work, enhance students' academic performance and foster innovations for energy sustainability. This is in agreement with Gill's (2003) statement that any positive programme outside classroom work brings a lot of benefits to students but there is still likelihood of exposing oneself to many risk and dangers.

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